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In situ and real time observation of tritium behavior in the metal by reversing associated particle spectra of DT neutron generator

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In the thermonuclear fusion reactor research, the tritium behavior in the metal, including adsorption, desorption, dissolution, diffusion, permeation, was critical to tritium economy and environmental safety, due to most material in the fusion reactor is metal, the tritium-metal interaction is a research focus in this field. The knowledge of the tritium behavior in the metal is a critical issue for the nuclear material research, it is necessary to perform tritium experiment due to there was no reliable and generous theoretical model for predicting tritium properties, for the purpose of evaluation of tritium amount and depth distribution contained in materials. While the strong demands for experiment data on the study of tritium in metals were suppressed by strict law and its costs. By utilizing the routine the associated alpha spectra in the DT neutron generator platform, a method which can in situ and real time observation of the tritium behavior in metal were developed. Based on the relationship between tritium profile in the target and the spectra of associated alpha, the reversion model for tritium depth profile was built, which the alpha spectra were used as model input. On the CIAE neutron generator, the alpha spectra in different tritium-titanium target phase were collected, through the built reversion model, each alpha spectra were converted to the tritium profile in the titanium, which presented the dynamic change of tritium distribution in the titanium. And the validity of these reversed tritium profile has been supported by the simulation result of the tritium-titanium interactions, which including the consideration of the isotope effects of tritium-deuteron. The presented was a cost-less methodology for real time acquiring the in situ tritium depth profile in the target material of D-T neutron generator.

Eligible for student paper award?

No

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